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EXAMINER
KILDAY, LISA A

ART UNIT	PAPER NUMBER
2829	

DATE MAILED: 06/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/982,003	SHIMADA ET AL.	
	Examiner	Art Unit	
	Lisa A Kilday	2829	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *RCE of 5/21/03* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14,16,18 and 20-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6-11,13,14,16,18,20 and 22-29* is/are rejected.

7)☒ Claim(s) *5,12 and 21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Claim Rejections - 35 USC § 112

Claim 1 amended to overcome rejections. 112 Rejections withdrawn for claim 1 and 8.

Response to Arguments

Applicant's arguments filed 5/21/03 have been fully considered but they are not persuasive. Applicant argues that the wafer temperature is kept approximately constant in Livesay-1 (WO 96/36070). Applicant's point is moot because this limitation is not in claim 1. Applicant asserts that Livesay-1 does not teach "causing to change a temperature of the substrate from a first heating temperature to a second heating temperature during the electron beam irradiating process." Applicant's argument is not persuasive for four reasons. The first reason is that the applicant admitted in their response in Paper No. 12 that Livesay-1 teaches heating the wafer at a temperature between 200-250°C (Paper No. 12: pg. 7, lines 20 – pg. 8, lines 4) and varying the temperature slightly. When Livesay-1 changes the temperature (pg. 9, lines 18-25; not col. 6, lines 18-25; abstract), Livesay-1 is causing the temperature to change from a first heating temperature to a second heating temperature. The second reason is that the applicant failed to claim the amount that the temperature was changed. Therefore, applicant's method does not preclude a temperature change whether it be an increase or decrease in temperature or major or minor temperature change. Third, applicant's assertion that the method of Livesay-1 is limited to keeping the temperature between 200-250°C is conclusory observation and applicant gives no reason, explanation, or evidence as to how Livesay-1 teaches how a substrate instantaneously reaches the

temperature of 200-250°C. Fourth, note that all temperature profiles must be somewhat gradual because according to heat transfer laws the temperature of the substrate would not instantaneously reach the desired temperature. Therefore, Livesay-1 teaches causing the temperature of the substrate to change from a first heating temperature to a second heating temperature.

Applicant argues that Livesay-2 (5,003,178) does not teach the limitation that the position of the substrate is changed in a range from not less than 50 mm to not more than 120 mm in distance from an electron beam generating section that generates the electron beam. This point is moot because the applicant does not give any reason, explanation, or evidence how Livesay-2 fails to teach the position of the substrate. Applicant then argues that Livesay-2 ails to teach heating the substrate and other limitations of claim 1. This argument is moot because Livesay-2 is relied upon to teach the limitations of claim 6 and 13.

Applicant argues that Livesay-2 teaches that the temperature of the substrate is at room temperature. This argument is moot because Livesay-2 is not relied upon to teach the temperature of the substrate.

Applicant's representative argues that Livesay-1 and Livesay-2 cannot be combined. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in

the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, both Livesay-1 and Livesay-2 are directed to treating a substrate during electron beam irradiating process, which is the same invention as the instant specification.

Applicant argues that Goo teaches that the temperature of the substrate is at room temperature. This argument is moot because Goo is not relied upon to teach the temperature of the substrate. Additionally, applicant's representative admitted that Goo does teach a substrate temperature of 500C and below (Paper No. 12: pg. 12, lines 19-21).

Applicant argues that it would not have been obvious to combine Goo and Livesay-1. This argument is moot because applicant's assertion is merely a conclusory observation and that the applicant gives no reason, explanation, or evidence in how Goo and Livesay-1 are not combinable. See MPEP 2145.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claims 22-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 22-6 recite the limitation "at least one of the pre-heat treatment and the post-heat treatment." There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) The invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1-4, 7-11, 14, 20 LAK are rejected under 35 U.S.C. 102(b) as being anticipated by Livesay et al. (WO 96/36070). In re claim 1, Livesay et al. discloses a method of manufacturing a semiconductor device in fig. 2 comprising: preparing a substrate (27) to be treated; and forming an insulation film (28) above the substrate, which includes applying an insulation film raw material above the substrate (pg. 9 line 10), the insulation film raw material including a substance or a precursor of the substance (pg. 2 lines 20-24), the insulation film comprising the substance (pg. 9 line 10), curing the insulation film raw material by irradiating an electron beam (45) on the substrate while heating the substrate in a reactor chamber (pg. 8 lines 19-25), changing at least one of parameter selected from the group consisting of pressure in the reactor chamber, temperature of the substrate (pg. 9 lines 15-23), type of gas having the substrate exposed thereto, flow rate of a gas introduced into the reactor chamber, position of the substrate, and quantity of electrons incident to the substrate per unit time when the electron beam is being irradiated on the substrate (pg. 9 lines 19-23, pg. 10 lines 21-24). Livesay-1 teaches heating gradually to a predetermined temperature. Livesay-1 teaches turning off the infrared quartz lamps off and on to varying duty cycle to control

the wafer temperature (pg. 9, lines 20-23). Livesay-1 teaches using the lamps (23) to irradiate and heat the substrate thereby controlling its temperature (pg. 9, lines 13-14).

In re claim 2, Livesay et al. discloses a method of manufacturing a semiconductor device according to claim 1, wherein the pressure in the reactor chamber is changed in a range from higher than 0 Torr to not more than 40 Torr (pg. 8 lines 20-21).

In re claim 3, Livesay et al. discloses a method of manufacturing a semiconductor device according to claim 1, wherein the temperature of the substrate is changed in a range from not less than 200 °C to not more than 500 °C (pg. 9 lines 19-20).

In re claim 4, Livesay et al. discloses a method of manufacturing a semiconductor device according to claim 1, wherein type of gas having the substrate exposed thereto is changed among a nitrogen gas, a rare gas, a reduced gas and a mixture of these gases, and whose oxygen concentration is not higher than 100 ppm (pg. 2 lines 6-7).

In re claim 7, Livesay et al. discloses a method of manufacturing a semiconductor device according to claim 1, wherein the quantity of electrons incident to the substrate per unit time is changed in a range from not less than 4 $\mu C/cm^2 \cdot$ sec to not more than 10 $\mu C/cm^2 \cdot$ sec (pg. 5 lines 22-23).

In re claim 8, A method of manufacturing a semiconductor device according to claim 1, further comprising:

at least one of pre-heat treatment which carried out before curing the insulation film raw material (pg. 10 lines 28-29, pg. 11 lines 18-26) and post-heat treatment which carried out after curing the insulation film raw material in the reactor chamber (pg. 14, claim 6 lines 1-15), changing at least one of parameter selected from the group consisting of pressure in the reactor chamber, temperature of the substrate (pg. 9 lines 15-23), type of gas having the substrate exposed thereto, flow rate of gas introduced into the reactor chamber, and position of the substrate when the at least one of the pre-heat treatment and the post-heat treatment is being carried out.

In re claim 9, Livesay et al. discloses a method of manufacturing a semiconductor device according to claim 8, wherein the pressure in the reactor chamber is changed in a range from higher than 0 Torr to not more than 40 Torr (pg. 8 line 21, pg. 13 claim 2) when the at least one of the pre-heat treatment and the post-heat treatment is being carried out.

In re claim 10, Livesay et al. discloses a method of manufacturing a semiconductor device according to claim 8, wherein the temperature of the substrate is changed in a range from not less than 200C to not more than 500C when the at least one of the pre-heat treatment and the post-heat treatment is being carried out (pg. 9 lines 19-20).

In re claim 11, Livesay et al. discloses a method of manufacturing a semiconductor device according to claim 8, wherein type of gas having the substrate exposed is changed among a nitrogen gas, a rare gas, and a mixture these gases

whose oxygen concentration is not higher than 100 ppm when the at least one of the pre-heat treatment and the post-heat treatment is being carried out (pg. 2 lines 6-7).

In re claim 14, Livesay et al. discloses a method of manufacturing a semiconductor device according to claim 1, wherein the insulation film is an organic silicon oxide film (pg. 1 lines 28-30 – pg. 2 lines 1-2, lines 20-26).

In re claim 20, Livesay-1 discloses a method of manufacturing a semiconductor device in fig. 2 comprising: preparing a substrate to be treated (27); forming an insulation film (28) above the substrate, which includes applying an insulation film raw material above the substrate (pg. 9, line 10), the insulation film raw material including a substance or a precursor of the substance (pg. 2, lines 20-24), the insulation film comprising the substance (pg. 9, line 10), curing the insulation film raw material by irradiating an electron beam (45) on the substrate while heating the substrate in the reactor chamber (pg. 8, lines 19-25), and changing at least one of the parameters selected from the group consisting of: pressure in the reactor chamber, type of gas having the substrate exposed thereto, flow rate of a gas introduced into the reactor chamber, position of the substrate, and quantity of electrons incident to the substrate per unit time when the electron beam is being irradiated on the substrate (pg. 9, lines 19-23; pg. 10, lines 21-24).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 6 & 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Livesay et al. (WO 96/36070) in view of Livesay (5,003,178). Livesay et al. (WO) teaches a method of manufacturing a semiconductor device in figure 2 by applying insulation film raw material, and curing the insulation film raw material by irradiating an electron beam on the substrate while heating the substrate in a reactor chamber. However, Livesay et al. (WO) does not teach that the position of the substrate is changed in a range from not less than 50 mm to not more than 120 mm in distance from an electron beam generating section that generates the electron beam. However, Livesay (US) teaches in figure 3 adjusting the position of the substrate (30) in a range from not less than 50 mm to not more than 120 mm in distance from an electron beam generating section that generates the electron beam (col. 6 lines 15-26). Therefore it would be obvious to one skilled in the art at the time of the invention to modify the process of Livesay et al. (WO) by adjusting the position of the substrate with respect to the electron beam generating section in order to diffuse the electron beam in a fairly uniform current density across the whole emitting area.

Claims 16, 18, 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Livesay et al. (WO 96/36070) in view of Goo et al. (5,989,983). In re claims 16, Livesay et al. (WO) teaches a method of manufacturing a semiconductor device in figure 2 by applying insulation film raw material, and curing the insulation film raw material by irradiating an electron beam on the substrate while heating the substrate in a reactor chamber. However, Livesay et al. (WO) does not teach that the insulation film

is a polymethylsiloxane film. However, Goo et al. teaches in figures 1A and 1B applying Spin-On-Glass (SOG) (ref. 13) and curing this layer with e-beam (18) (col. 4 lines 56-60, col. Goo et al. teaches that the SOG is polymethylsiloxane (col. 1 lines 43-52). Therefore it would be obvious to one skilled in the art at the time of the invention to modify the process of Livesay et al. (WO) by substituting Cu for Aluminum as the wire's main material in order to deposit a SOG at low temperature for better planarization and excellent crack resistance.

In re claims 18, 29 Livesay et al. (WO) teaches a method of manufacturing a semiconductor device in figure 2 by applying insulation film raw material, and curing the insulation film raw material by irradiating an electron beam on the substrate while heating the substrate in a reactor chamber and embedding a wire on a surface of the insulation film. However, Livesay et al. (WO) does not teach that the wire's main material is Cu on a surface of an insulation film. However, Goo et al. teaches in figure 3A embedding a wire whose main material is Cu (21), (col. 7 lines 43-51). Therefore, it would be obvious to one skilled in the art at the time of the invention to modify the process of Livesay et al. because it is well known in the art that Copper is a common substitute for Aluminum wiring.

Allowable Subject Matter

Claims 5, 12, and 21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: In re claims 5 & 12 prior art does not teach or suggest a method of manufacturing a semiconductor device according, wherein the flow rate of gas having the substrate exposed thereto, the gas being introduced into the reactor chamber, is changed in a range of from higher than 0 slim to not more than 25 slm during either the pre-heat or post-heat treatment.

In re claim 21, prior art does not teach or suggest pre-heat treatment, which carried out before curing the insulation film raw material, and post-heat treatment, which carried out after curing the insulation raw film material in the reactor chamber.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Lucey (5,306,739).

Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist whose telephone number is (703) 308-0957. See MPEP 203.08.

Any inquiry concerning this communication from the examiner should be directed to Lisa Kilday whose telephone number is (703) 306-5728. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamand Cuneo, can be reached on (703) 308-1233. The fax number for the group is (703) 305-3432. MPEP 502.01 contains instructions regarding procedures used in submitting responses by facsimile transmission.

Lisa Kilday

LAK

6/13/03